EVALUATION OF PRE-EVACUATION BEHAVIOR AMONG STUDENTS AND STAFF IN ENGINEERING CAMPUS, UNIVERSITI SAINS MALAYSIA

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SCHOOL OF CIVIL ENGINEERING
UNIVERSITI SAINS MALAYSIA
2022

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AMONG STUDENTS AND STAFF IN ENGINEERING CAMPUS,
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By

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This dissertation is submitted to

UNIVERSITI SAINS MALAYSIA

As partial fulfilment of requirement for the degree of

BACHELOR OF CIVIL ENGINEERING (HONS.)
(CIVIL ENGINEERING)

School of Civil Engineering
Universiti Sains Malaysia   AUGUST 2022

UNIVERSITI SAINS MALAYSIA

SCHOOL OF CIVIL ENGINEERING
ACADEMIC SESSION 2021/2022

FINAL YEAR PROJECT EAA492/6
FINAL DRAFT ENDORSEMENT FORM

Title: EVALUATION OF PRE-EVACUATION BEHAVIOR AMONG STUDENTS AND STAFF IN ENGINEERING CAMPUS, UNIVERSITI SAINS MALAYSIA

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ACKNOWLEDGEMENT

First and foremost, I would like to express my heartfelt appreciation to my supervisor, Dr. Noorhazlinda Abd Rahman, who has been a source of knowledge and advice throughout this project. She was continuously guiding and assisting me throughout this dissertation. I was able to handle any challenges I experienced while writing this dissertation with her assistance. Her advice and assistance were extremely beneficial to me during this study. This dissertation would not have been possible without her supervision and continuous assistance.

I would also like to thank everyone of the staff and students at Universiti Sains Malaysia's Engineering Campus for their help and support during the data collection process for my questionnaire survey. I would want to express my heartfelt appreciation to everyone who took the time and effort to complete the survey. Without their cooperation, this dissertation cannot be completed on time.

Aside than that, I am incredibly appreciative for the feedback I received from all the respondents who completed my questionnaire survey. To be honest, data cannot be collected without their cooperation, therefore this research would be incomplete.

I would want to thank my entire family, especially my parents, for their unwavering support, care, and love during my studies. I'd want to thank all my friends for their inspiration, unending cooperation, and friendship throughout the last few years. This thesis would not have been possible without their assistance. Thank you very much.

ABSTRAK

Disertasi ini mengkaji tingkah laku pra-pemindahan dalam kalangan pelajar dan kakitangan di kampus kejuruteraan Universiti Sains Malaysia (USM), dengan memberi penekanan kepada bagaimana penghuni di kampus kejuruteraan, USM berkemungkinan bertindak balas sekiranya berlaku kecemasan. Menurut maklum balas 185 responden tulen, kebanyakan penduduk memahami situasi itu dan mula berpindah ke lokasi yang lebih selamat apabila mendengar amaran itu. Akibatnya, sesetengah daripada mereka mengambil masa beberapa saat untuk memastikan mereka memahami keadaan mereka sebelum bertindak. Selain bertujuan untuk mengkaji tingkah laku sebelum pemindahan penghuni, faktor demografi yang mempengaruhi tingkah laku penghuni juga turut dikaji. Menurut data yang diperoleh melalui analisis statistik menggunakan perisian SPSS, keputusan ujian menunjukkan bahawa jantina tidak mempunyai pengaruh terhadap tingkah laku pra-pemindahan mereka kerana tidak terdapat perbezaan yang signifikan antara perempuan dan lelaki. Walau bagaimanapun, data mendedahkan bahawa penghuni yang mempunyai pengalaman terdahulu dan latihan keselamatan mempengaruhi cara mereka bertindak balas semasa kecemasan. Selepas mendengar penggera, responden cenderung untuk segera mengosongkan bangunan dan terus ke kawasan perhimpunan. Tambahan pula, dapatan menunjukkan tiada perbezaan yang signifikan dalam kumpulan umur tetapi tidak dalam tahap latar belakang pendidikan. Penghuni mengabaikan penggera dan menunggu beberapa saat dan bukannya bertindak sewajarnya. Mereka juga memaklumkan kepada orang lain apabila menyedari ada kecemasan. Selain itu, mereka cenderung untuk menelefon keluarga atau rakan mereka untuk memberitahu keadaan semasa mereka. Penemuan kajian boleh membantu pentadbir universiti membangunkan dasar yang sesuai, penyelesaian reka bentuk dan latihan untuk pemindahan selamat yang cekap. Selain itu, hasilnya merupakan sumber penting untuk membina model matematik dan meningkatkan keselamatan di institusi pendidikan untuk pemindahan kakitangan dan pelajar yang lebih selamat.

ABSTRACT

This dissertation studies pre-evacuation behaviour among students and staff at the engineering campus of Universiti Sains Malaysia (USM), with an emphasis on how occupants at engineering campus, USM likely to react in the event of an emergency. According to the response of 185 genuine respondents, most of the residents grasp the situation and begin to evacuate themselves to a safer location when they hear the alert. As a result, some of them take a few seconds to ensure that they understand the circumstance they are in before acting. Besides aiming to study the pre-evacuation behaviour of the occupants, the demographic factors that influence the behaviour of the occupants also being studied. According to the data analysis using SPSS software, the test result demonstrated that gender had no influence on their pre-evacuation behaviour because there was no significant difference between females and males. However, the data revealed that occupants with prior experience and safety training influenced how they reacted during an emergency. After hearing the alarm, respondents tend to instantly evacuate the buildings and proceed to the assembly area. Furthermore, findings revealed no significant differences in age groups but not in educational background level. The occupants ignore the alarm and wait a few seconds instead of act accordingly. They also informed others once aware there is an emergency. Besides, they tend to call their family or friends to tell their current situation. The study's findings can help university administrators develop appropriate policies, design solutions, and training for efficient secure transfers. Aside from that, the results are a significant resource for constructing mathematical models and enhancing safety in educational institutions for safer evacuation of staff and students.

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CHAPTER 1

INTRODUCTION

1.1 Background Study

Pre-evacuation behavior is a behavior that people will portray when they are dealing with an emergency incident. Different people will exhibit a variety of behaviors. For example, some may evacuate immediately, while others may disregard fire alarms and continue their activities regardless of the surrounding circumstances. Furthermore, others may attempt to fight the fire to save others in case of fire incidents. All these behavioral patterns are typically influenced by factors such as a person characteristic, past experiences, background study, emergency incidents characteristics, age, ability to read the situation, to name a few. The critical aspect of this issue is that these behavioral patterns may cause a delay in evacuation movement which worsens the situation.

Several earlier studies investigated residents' likely behavior while fleeing train station (Shiwakoti et al., 2017), airports (Shiwakoti et al., 2020), and ships (Wang, 2020). Because of cultural factors in human behavior and decision-making during catastrophes (Lin et al., 2020), the findings of earlier studies may not be immediately relevant to other nations. Malaysia, for example, is a multi-ethnic and multi-lingual community. Although many Malaysian ethnic groups share similar values (for example, honesty, accountability, readiness to serve, and taking risks), their priorities differ (Fontaine & Richardson, 2005). Furthermore, studies undertaken in the previous decades revealed that the Malaysian community lacks knowledge and awareness in reacting to emergencies and natural catastrophes (Harsty & Utaberta, 2018). In another study, the researchers visually inspected and verified all crowd behavior predictions under emergency conditions using computer graphics

interpretation (Shiwakoti et al., 2008; Duives et al., 2013; Kalakou and Moura, 2014; Shi et al., 2015). According to the findings of this article, most passengers do not have a good comprehension of the information tools and procedures during an emergency evacuation in a train station (Shiwakoti et al., 2016). They assumed it would be simple to navigate during an emergency, but it turned out to be a challenge because they were unfamiliar with the evacuation procedures at that railway station. Furthermore, because they rode the train frequently, several respondents were aware of how to reach the entrance or exit during an emergency to save their selves.

Based on past research findings, Malaysian citizens lack knowledge and awareness in responding to an emergency, which may result in delaying protection action during the disaster. Even while this problem may not affect everyone, it can have an impact on those around you. To augment prior findings, a study was undertaken at Engineering Campus, USM because it has thousands of residents and appears to be a reliable location to collect data during this pandemic. Furthermore, this study may be very useful to other universities, as Malaysia has many popular educational institutions, and even foreigners have been called to be one of their enrollments. The major purpose is to determine how residents of diverse statuses, ages, educational backgrounds, races, and past experiences will respond in the event of an emergency. The Engineering Campus at USM appears to be the most dependable place for this study, as it fits the major goal of this study. This research will also assist university administration in preparing for and managing the issue, as well as improving their techniques of dealing with it. The expected findings from this study were that to explore the occupant's behavior during emergency and what factors that influence their behavior and reaction to meet with the desired objectives.

1.2 Problem Statement

According to the previous study, the inhabitants often must either rescue themselves or rely on others in their immediate area during an emergency (Rubadiri et al., 1997). Furthermore, it may be claimed that actions are taken based on people's self-understanding of the circumstance, their purpose to act, and the considerations involved before these acts are carried out. Pre-evacuation behavior refers to how individuals behave prior to an emergency escape. Building evacuation is divided into two stages: pre-evacuation and evacuation (Kuligowski et al., 2010). The choice of residents to leave after receiving the first alarm signals, which exactly indicates the change from pre-evacuation to evacuation behavior, is critical in the pre-evacuation phase.

Therefore, in some cases, people did not evacuate when the emergency alarm went off and waited for the instructions from the public address (PA) system or from management to evacuate. In other cases, people moved to exits quickly and used the emergency call buttons once they were aware of the emergency. Thus, this study is carried out to scrutinize the pre-evacuation behaviors among students and staff in Engineering Campus, USM during an emergency and how they respond to the event. In addition, we also want to know how the differences in demographic factors, i.e., age groups, educational backgrounds, races, gender, and life experiences, influence the students and staff behavior during an emergency evacuation in Engineering Campus, USM.

The findings from this study are believed can help university's safety officers to provide an effective emergency response plan and understand some important implications for emergency preparedness and devising management strategies in emergency evacuations.

1.3 Objective

1. To explore pre-evacuation likely behavior among students and staff in Engineering Campus, USM.

2. To investigate the demographic differences regarding pre-evacuation likely behaviour among students and staff in Engineering Campus, USM.

1.4 Scope of Work

In this study, data on pre-evacuation behaviour among students and staff are gathered using a questionnaire survey administered through Google Forms. An online platform would be the most acceptable and appropriate way to utilize because it is quick to use and does not require additional paperwork. Furthermore, because the survey form can be accessed through smartphone, which is the least burdensome for responders. Due to the Covid-19 pandemic, this study is exclusively confined to the Engineering Campus at USM, making data collection easier.

In addition, this study has a limitation in conducting the survey, which is that the survey can only be completed by students who are currently residing in campus. Those who are not in the campus are not eligible to respond to the survey. This is because, this study aims to study the pre-evacuation behaviour among staffs and students in the campus area, thus all the respondents need to be in the campus and familiar to all the buildings and the campus surrounding. As a result, the google form has been configured so that those currently on campus are led to the survey, while those outside the school are instantly terminated.

Furthermore, this study was statistically analysed using IBM SPSS software, which exclusively used non-parametric analysis. This is because, after collecting all the survey data, normality verification was performed using SPSS software. The collected results reveal that all the significant values for all the statements were less than 0.05. As a result, the data set was deemed non-normally distributed, and a non-parametric technique was used for further analysis.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter breaks down the research into various components and discusses the findings and outcomes obtained by past researchers regarding the components. At the beginning of this chapter, the definitions of the fundamental concepts of pre-evacuation and evacuation were presented. These two phrases may appear to be synonymous, however they refer to two distinct entities with distinct meanings. This chapter also review the relationship between demographic parameters and human pre-evacuation behaviours. This enables us to comprehend the motivations for human behaviour, and of course, this issue was supported by past research findings, ensuring that the data is highly reputable. Moreover, the evacuation timeline was also reviewed to illustrate the variations between the evacuation phases and to aid readers in their comprehension. In this part, theory of human emergency response was further discussed in terms of performance-based design and how this matter can enhance the life safety analysis. Also, this chapter aggregates the data of numerous researchers to provide context for the study's anticipated outcome. Finally, an overview is provided to conclude this chapter.

2.2 Pre-evacuation and emergency evacuation behaviour in general

In the middle of any emergency situation (e.g., fire either in a building or other public facilities) that needs occupants to evacuate from the building, pre-evacuation behaviour refers to the actions taken by occupants between the time the alarm begins to sound and the time they become aware of the situation and begin evacuating the building. Typically, this behaviour varies amongst individuals due to everyone's unique reaction and ability to read a situation. Therefore, do not be surprised if there are occupants who

remain relaxed while going about their daily routines and others who react swiftly to the circumstance. Meanwhile, evacuation behaviours refer to the steps taken by the building's occupants to flee the threat. In general, evacuation behaviours follow the pre-evacuation phase. This stage is more likely one in which people have grasped the situation and are evacuating themselves to the safest location possible. Thus, by comprehending these two phrases, it will be easier to appreciate the purpose of this study and the desired consequence.

2.3 Evacuation Timeline

Pre-evacuation phase was referring to the phase whereby the time taken by residents to respond to an emergency (Ronchi & Nilson, 2016). According to the Cambridge Dictionary, (2022), to evacuate means to move people from a dangerous location to a safer location or to empty anything of its contents. Thus, evacuation can be said as an action to flee ourselves from a hazardous situation to keep us safe. Essentially, it is the amount of time they wait after the alarm has gone off before beginning the evacuation process. It should be emphasised that pre-evacuation phase can vary depending on a variety of internal and external factors (Ronchi & Nilson, 2016). As a result of factors such as the type of warning, residents' health conditions, and how well a facility is managed, pre-evacuation times can vary widely. Some researchers refer to pre-evacuation as pre-movement, indicating that during the response or reaction phase, people may engage in actions like packing goods, looking for other people and confirming information from others before fleeing (Galea et al., 2017; Haghani et al., 2019a). In addition to social influence distance from the exit and a secure position, pre-evacuation phase is a significant component of total evacuation time (Haghani et al., 2019a).
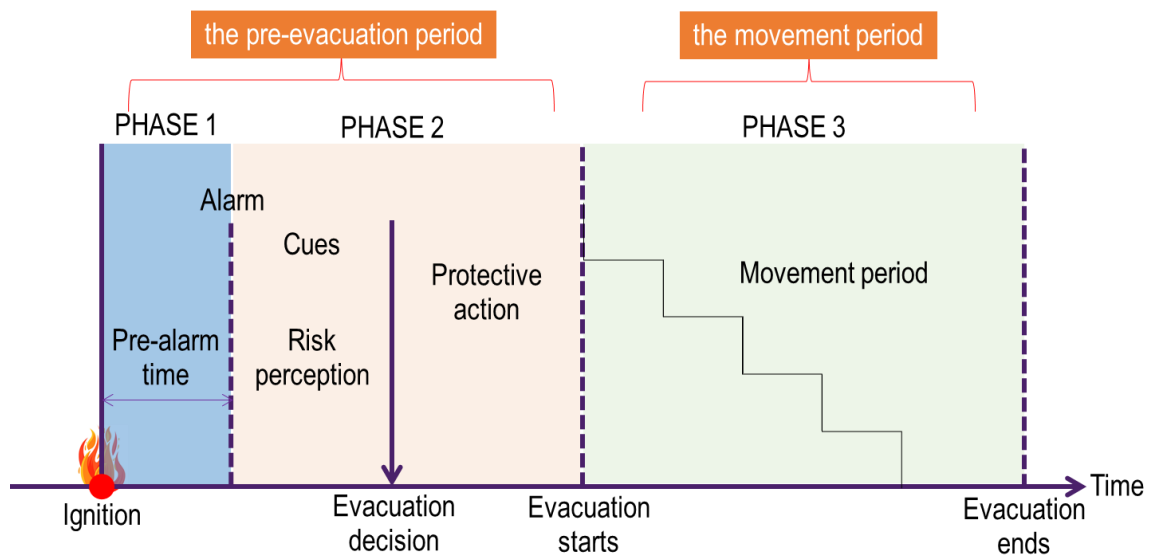
Figure 2.1: Illustration of Evacuation Timeline

The goal of creating a comprehensive theory of human emergency response is to enhance life safety analyses in performance-based design. Human behaviour is complicated, and more study is needed to comprehend the human evacuation behaviour. As a result, the human response to an emergency is commonly divided into two discrete phases: pre-evacuation and movement, with little understanding of the behavioural mechanisms that occur within each.

The pre-evacuation period is estimated from the time ignition begins until a person or group commences a deliberate evacuation movement to a safe area. The evacuation or mobility phase refers to the time when a person goes to safety on purpose. The pre-evacuation and movement phases include extra sub-phases that the engineer should be aware of. This is critical when constructing the evacuation path, as it will be lot easier to comprehend for everyone regardless of their age, as we already understand how people behave based on the timeframe.

2.4 Human Evacuation

According to (Kuligowski, 2016), three sub-phases can exist within the pre-evacuation period namely the pre-alarm phase, the evacuation decision-making phase, and the protective action phase.

i. The pre-alarm phase is defined as the period between the start of the fire and the activation of the building alarm and/or the exposure of building inhabitants to signals from the fire event (i.e., seeing smoke or being informed about the fire event by a staff member).

ii. The evacuation decision-making phase, during which building inhabitants are exposed to or seek out cues/information from the fire event and others in the building and must determine whether to protect themselves (e.g., leave) after processing this information.

iii. The protective action phase, during which individuals take measures, such as gathering personal possessions or supporting others with evacuation preparations, to protect themselves or others before evacuation begins.

According to the preceding stages, it can be concluded that people react to emergencies in phases and that their reactions differ according to person. The extant research on land-based traffic accidents demonstrates that various individuals choose to respond aggressively or passively to situations. Some people delay evacuation until the alert is validated by Public Address (PA) systems. However, other studies indicate that when individuals perceive danger, they may quickly rush to emergency exits or muster stations (Shiwakoti et al., 2017; Fridolf et al., 2013). Additionally, research have established those contextual variables influence pre-evacuation, and that people commence evacuation measures at varying periods following the evacuation notice (Bode and Codling, 2019; Haghani et al., 2019a; Lovreglio et al., 2019). Meanwhile,

some would opt to validate the incident's veracity following the alarm's sound (Casareale et al., 2017). Additionally, there is a mechanism for categorising emergency evacuations, such as social groups comprised of close family and friends. In this case, individuals assist one another during the evacuation process and negotiate the evacuation plan (Kvamme, 2017; Mawson, 2007; Sime, 1983).

Additionally, they enter the mobility phase only after going through these three phases. The mobility phase is when individuals begin to recognize or accept the situation clearly and begin taking measures to flee to a safer location. Individuals exhibit a variety of human behaviours throughout this period. Some may assist one another, while others may be self-centred to protect their own lives. For instance, individuals have showed competitive conduct such as shoving in certain instances while demonstrating cooperative behaviour such as keeping calm and assisting others (Chertkoff & Kushigian, 1999; Drury et al., 2009). It can be concluded that during the mobility stage, individuals focus exclusively on evacuating the building or emergency location, with no other considerations other than their own survival. This behaviour is diametrically opposed to what individuals demonstrated during the pre-evacuation period, when most people tended to disregard it.

Moreover, when an emergency occurs within a building, the pre-evacuation time can be much longer than the actual evacuating time, thus understanding behavioural process during the pre-evacuation phase is critical. People can also make similar judgments and acts during the mobility phase, especially when they are confronted with extra environmental stimuli. Demographic factors also can be the reasons to how individuals will react to these phases.

2.5 Factors Influence Behaviour During Evacuation

During an evacuation, there are several elements that might impact a person's actions. People of varying ages show various forms of conduct, whether they are proactive or passive. According to Mohamed et al. (2021), young passengers were more reactive than elderly passengers while Kanno et al. (2006) found that elderly people were found to be more reactive than the young. Under five different of age groups, i.e., under 20, between 21 and 30, between 31 and 40, between 41 and 50 and between 50 and 60, there will be a wide range of responses from each of these age groups to the scenario and how they respond to the evacuation process. To put it another way, it is possible that their reactions and sensitivity to the circumstance are different.

Next, it is thought that gender could have an impact on people's behaviour during evacuation. Men tends to be more rational in their decision-making and interpretation of situations, while women are more emotive. This remark may not be true for everyone, yet it may be accepted since we understand the nature of women and men. Due to this abrupt emergency occurring, women are more likely to suffer from a panic attack than males, who are more likely to remain cool and handle the situation appropriately. Men also have a capability to fight the situation as they believe in themselves compared to women who might need a group of people to give them the strength to fight back. For example, during the "Costa Concordia" disaster, a woman and her coworkers packed their belongings and travelled together to the boarding station (Casareale et al., 2017). This was described as the behaviour of evacuees in social groups, i.e., social groups with close relationships such as relatives or friends to assist each other in the evacuation process and to establish the evacuation plan, during the emergency evacuation process (Kvamme, 2017).

In addition, this problem is exacerbated by one's prior experiences. When faced with an emergency, there are individuals out there who have been there before. As a result, individuals are more likely to be able to handle the situation to save their own lives because of their previous trials and experiences. In addition, there are some who have already taken safety training. As a result, they'll know what to do first in the event of an emergency. Maps and departure routes to a safe location can be found, for example. The findings of Mohamed et al., (2021) clarified these claims by stating that people are more likely to find their own evacuation path as familiarity rises. The idea was that occupants who are familiar with the buildings or situations like this prefer to move towards the exit on their own and swiftly handle the situation. Additionally, another study found that persons who have received safety training are more sensitive and quicker to respond in the event of an emergency (Fridolf et al., 2013). This is because they had already been exposed to that type of event and understood how to respond when faced with a similar situation in real life. As a result, they had previously prepared themselves by learning all those safety skills, which developed the way they behave and think.

Furthermore, a person's educational background is a significant aspect during an emergency because it might influence how they react or handle the issue. According to Gerges et al. (2016), an educated individual is more likely to flee swiftly than an uneducated person, who is more likely to engage in other activities before fleeing. According to their findings, persons with a bachelor's degree or more would promptly escape a building upon hearing an alert if they were unfamiliar with its layout. This finding demonstrates that a difference in educational background can influence how an occupier reads a situation and how swiftly they react to it. Moreover, it was discovered that education level had a statistically significant impact on impatient behavior. The

higher the level of education, the less likely passengers will be impatient. This demonstrates how sensible they can be in the face of an emergency. In another way, they understood how to handle the situation and began to act to save their lives while also leading others to a safest place. Thus, in such a life-or-death situation, a person's capability to employ critical thinking is more vital since they must act swiftly to create a solution. The ability of people to react rapidly to a situation varies according to their educational background.

Finally, during an emergency evacuation, people of different ethnicities will behave in different ways. This may be attributable to the way they were raised. Raising children is an art form that is unique to each race's beliefs and practices. Their early experiences may have a bearing on how they respond to an evacuation in the event of a disaster. The results of earlier research may not be immediately relevant to other nations because of cultural differences in human behaviour and decision-making during emergencies (Lin et al., 2020). Multi-ethnic and multi-lingual, Malaysia is one example of this. But even though many ethnic groups in Malaysia share many of the same values (such as a willingness to help and risk taking), their priorities are different (Fontaine and Richardson, 2005).

2.6 Related Research on Pre-Evacuation Behaviour

Some of the related research on pre-evacuation were compiled and review accordingly in this section. Flooding is one of the most devastating and common natural disasters that occur in many places of the world (Jonkman, 2005). Much research was carried out to investigate human behaviour during a disaster or emergency. Typically, studies focused on evaluating performance using computer simulations, controlled experiments, or field observations. Bernardini et al. (2020), for example, evaluated the

walking speeds of 203 volunteers ranging in age from 8 to 68 years. They were told to walk and run in a rectangular channel 12 m long and 1 m broad, with water filled inside ranging from 0.2 m to 0.7 m deep. Based on their findings, they discovered that the evacuation pace reduced and became slower as the water level rose. This is due to the water pressure pressing against the volunteer's leg, making their muscle articulation motion difficult and sluggish. Furthermore, males were faster than females during the evacuation in this experiment.

Musolino et al. (2020), on the other hand, investigated the comparison of several flood hazard assessment methods, namely, mechanics-based approaches and experimental-based approaches. To develop stability criteria, the mechanics-based method considers floodwater properties such as depth and speed, as well as pedestrian characteristics such as weight and height (Musolino et al., 2020), whereas the experimental-based method solely categorises floodwater parameters (Martinez-Gomariz et al., 2016). Based on these two approaches, they came out with a solution that mechanics-based approaches were more suitable in assessing flood hazards.

Research was done in an underground rail station inside a retail centre in Melbourne to investigate passengers' reactive and proactive behaviours. According to the findings, Shiwakoti et al. (2017), passengers are more inclined to wait for orders from staff rather than fleeing the building on their own. As a result, individuals prefer to exhibit reactive conduct, such as waiting for staff, as opposed to proactive behaviour, in which they discover their own method to react fast and proceed to the exit. This is related to the passengers' duties, whether they were passengers or crew members, as familiarity with the emergency procedures was a key aspect in truly understanding the situation and making decisions.

Furthermore, a study conducted by Stedmom et al. (2017) to compare the behaviours of aviation and train passengers found that aviation passengers were more reactive since they expected to be given instructions on what to do. Rail passengers, on the other hand, were expected to be more proactive and self-sufficient in the event of an emergency evacuation. This occurs because, in aviation, they frequently standardise the flight attendance to do the announcement, so they tend to rely on the announcement when an emergency occurs, although there is no such thing in train transport.

Case studies of actual underground transportation system evacuations revealed that people can take a proactive or reactive attitude in various disaster situations (Fridolf et al., 2013). In the case of the King's Cross fire in London in 1987, for example, people reacted after the emergency alarm sounded. Despite receiving cues from the fire, they did not respond or evacuate until told by the public address (PA) system and authorities or advised by station personnel. Meanwhile, in the Burnley tunnel catastrophe in Melbourne in 2007, individuals were more active and did not wait for instructions, instead acting quickly and moving toward the exit after getting emergency cues.

Human behaviour during an emergency has also been studied using competitive and cooperative behaviours. During the evacuation phase of the World Trade Center tower collapse in September 2011, the occupants cooperated and attempted to aid one another despite its current danger and life risk (Gershon et al., 2012). Furthermore, Cocking et al., (2009) reported that during the World Trade Center evacuation in September 2011, almost 99.2 percent of people demonstrated altruistic and cooperative behaviours. Males were more aggressive than females in terms of competitive behaviour. Another study found that some male passengers displayed competitive behaviour during the 2012 "Costa Concordia" ship incident. To get into the lifeboats, they pushed through the crowd, injuring other passengers (Kvamme, 2017).

2.7 Demographics Effects on Pre-Evacuation Behaviour

Based on previous studies reported in Table 2.1, occupants' pre-evacuation behaviours during an emergency were largely explored. This pre-evacuation behaviour was classified into five demographic factors that influenced how occupants responded to the scenario (i.e., gender, age, educational background, races and past experiences). These five elements were the most important to discover and evaluate to determine how they affected the occupants' pre-evacuation behaviour during an emergency. The following are just a handful of the findings from the reviewed one.

Table 2.1: Findings of Previous Studies on Pre-evacuation behavior during emergency

BIL	Demographics Factors	Author	Finding
1		N.Shiwakoti et al. (2017).	The ordinal regression findings revealed that female passengers were more likely than male passengers to press the red emergency button, phone 000, wait for instructions from station workers or PA and wait in the assembly area, in comparison to male passengers.
		Venkatesh and Morris, (2000).	The result was expected as men had been found to be less likely to ask for direction.
	Gender	Hebert et al., (1997).	Although there was no gender difference on ''help other people'', male passengers were more likely to ''push other passengers'' compared to female passengers. This result was expected as females would generally exhibit higher social desirability and social approval bias in self-report of behaviours.
		Vugt et al. (2007); Ahlgren and Johnson, (1979)	It was said that males have been found to be more competitive in many types of behaviour.
		N.Shiwakoti et al. (2017).	In addition, male passengers were found to be more likely to choose the least crowded exit than female passengers, while female

			passengers were found to be more likely to follow other passengers.
2	Age	Ahola et al. (2014)	Found that the older the passengers and the larger number of people travelling together, the more likely they are to help others. This may be due to the stronger social cognition of the seniors and the mutual trust between people in the group.
		Shiwakoti et al. (2016)	Regarding the effect of age on self-awareness and self-preparedness, older passengers have less awareness and readiness than younger passengers.
		Baffoe and Shiyuan (2017).	that most of the older subway riders have little or no knowledge about emergency safety measures or safety symbols.
		Pan et al. (2019).	During events that typically attract large crowds, pedestrians who are younger than age 45 tend to evacuate faster.
		Mohamed et al. (2021).	Malaysian passengers, young passengers were more reactive than elderly passengers.
3	Education	Wang (2020).	Education level has a statistically significant impact on impatient behaviour. The higher the level of education, the less likely passengers are to exhibit impatient behaviour.
		Fridolf et al. (2013).	Found that people with safety education will be more sensitive and quicker to respond if an emergency occurs.
		Gerges et al. (2016).	An educated person is more likely to evacuate quickly than uneducated people, who are more inclined to do other activities before fleeing. Those who stated, they were educated to a degree level or above would quickly evacuate a building upon hearing the alarm if they were unfamiliar with its layout.
4	Races	Leib et al. (2012).	It is to be noted that cultural differences have been found to influence passengers' ability to wayfinding in the airport.
		Project BESECU (2013).	Understanding of cross-cultural and ethnic differences of human behaviour in emergency conditions is important to improve safety and security related communication, instructions, and procedures at airport to enhance the evacuation process.
		Shiwakoti, et al. (2020).	Differences in culture (both social and fire cultures) may influence response behaviour as well as response times.

| 5 | Past Experiences | Shiwakoti, et al. (2020). | In Melbourne Airport, it was observed that respondents who had previous exposure to emergency evacuation were less likely to move to the exits immediately. This observation suggests that these respondents are more likely to wait for confirmation of information from airport staff or PA announcement before evacuating the area. |

2.8 Summary

This section's purpose was to offer the reader an indication of what to expect in the rest of the chapter. In addition, the description of the topic's keyword was clearly described and explained to avoid any misunderstandings among the readers. Pre-evacuation and evacuation are clearly distinguished from one another. Normally, these two statements are treated as interchangeable, although they mean two different things. It is clear at this point what the subject matter is all about. In addition, an illustration of the evacuation timeline is included in this chapter to aid readers.

CHAPTER 3

METHODOLOGY

3.1 Overview

The general flow of this study is covered in depth in this chapter, beginning with the problem definition and progressing to data collecting and analysis. Furthermore, this chapter also offer significant site selection concerns as well as some basic facts about the chosen field of study. First, an appropriate topic was picked for this study after careful assessment of the advantages and downsides. Scoping and searching for previous articles on the issue were conducted to discover what previous researchers had accomplished in their findings. With this, information on what previous researchers had not done yet in their research may be sorted out and used as a goal for current study. Following this recognition, the issue statement was discovered, which led to the objectives of this study. This was a survey-based study, and the data was collected through a set of questionnaires disseminated via internet platforms. Furthermore, the collected data was examined with SPSS software to ensure the questionnaire's reliability and validity. Finally, the methodologies used in data gathering and analysis are described. Figure 3.1 depicts the flowchart for this project.

3.2 Information on the Chosen Study Area

Universiti Sains Malaysia (USM) is a Malaysian public research university. It is one of Northern Malaysia's oldest colleges of higher learning, having been established on 1 June 1969 as a statutory organization with its own constitution. It has three campuses: one on the island of Penang, one in Kelantan, and one in Nibong Tebal, Malaysia. USM is Malaysia's only APEX University, a distinction bestowed by the Ministry of Higher Education. Among other things, the APEX (Accelerated
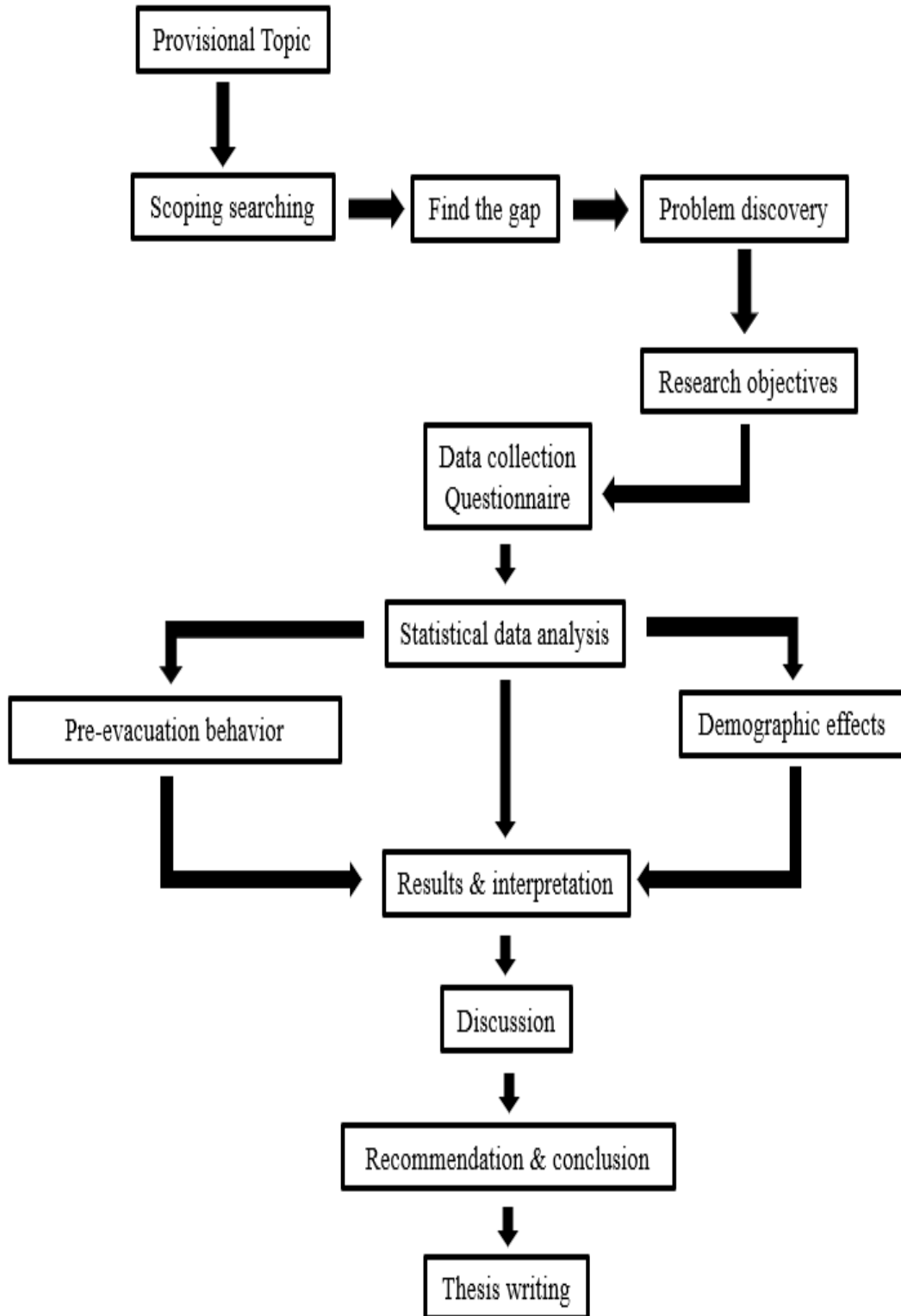
Figure 3.1: Flowchart of Methodology

Programmed for Excellence) agenda aims to accelerate the university to become one of the top institutions of higher learning in the world. Even though USM has gained APEX university status, there is still a dearth of understanding in terms of safety evacuation during an emergency, whether among students or staff.

Engineering Campus, USM was chosen as the study area because the university has a multi-racial population that meets the aims of this study. Furthermore, this appears to be the safest location to be performed during this pandemic, which is worsening by the day. Furthermore, it is useful in terms of demographic aspects that can be detected in a single location. Furthermore, USM is a multi-story structure that must be examined and studied to determine how inhabitants would react during an emergency and what factors substantially influence their pre-evacuation behaviours. For example, how would they evacuate the multi-story buildings and what stimulus will they produce during the emergency can be identified. In addition, the targeted respondent can be achieved as the intake of the students at one time was thousands of students and this much not included the academic staffs, researchers, and others.

3.3 Research flow

Figure 3.1 depicts an overview of how current study is being carried out. Whatever questions going to be constructed must be related to the study's objectives. This is because, the questions must be able to answer the objectives or else they will be meaningless, and the data will not be credible for this study. Since this study aims to foresee what demographic factors strongly affected the pre-evacuation behaviours of the students and staff in USM Engineering Campus, thus the survey was split into 2 parts. The first portion requires responders to answer demographic questions, which are comprised of multiple questions (e.g., role, age, gender, educational background, and others). These questions clarify their pre-evacuation behaviours and categorize their responses accordingly. The second part of this survey was the general statement to see whether they recognize the situation they are facing and how they will react to the situation. These two parts combined to eventually answer the two main objectives of this study. Lastly, these data were analysed using SPSS software to find the frequency, mean and standard deviation of the data. The reliability and validity of the survey questions can be known. Therefore, any alteration to the questions can be performed so that the precision of the question can be narrowed down closer to the objectives.

Table 3.1: Sections in Questionnaire

Parts	Items
Part A	Demographic Factors
Part B	Pre-evacuation Behaviour Among Students and Staff in Engineering Campus

3.3.1 Part A

Under this part, the respondents were asked to answer a few demographic questions. The questions related to:

i.   Genders

ii.   Age

iii.   Race

iv.   The building that currently work/stay

v.   Serving time at USM

vi.   Experience in any evacuation/safety education training

3.3.2 Part B (Measurement Statements)

Under this part, the respondents were asked to reflect on their pre-evacuation behaviours during the emergency. This section tends to stress more on their response and recognition towards the incident. As a result, by gathering more responses, we can discern the pattern of their actions at the scene. Likert scale: 1-(Strongly Agree), 2-(Disagree), 3(Neutral), 4(Agree), 5(Strongly Agree) was utilized.

Table 3.1: Recognition Statements

No.	Statement
1	I understand that when alarm sounds, it means there is an emergency.
2	Most of the time, I do nothing (or just ignore) after hearing the alarm.
3	Usually, I wait for the confirmation on the emergency first before evacuating.
4	After hearing the alarm, I wait a few seconds/minutes to respond or act.
5	I am aware that I should evacuate immediately after hearing the alarm.

Table 3.2: Response Statements

No.	Statement
1	I will directly look for exits after hearing the emergency announcement.
2	I look for the evacuation map to find the exits and assembly area.
3	I will follow what others do.
4	I prefer to observe others' movements.
5	I will make a call (call family or friends) to inform them.

3.4 Questionnaire Design

A questionnaire is used by the researcher in a survey to gather statistically meaningful information about a specific topic. Questionnaires, when correctly created and responsibly administered, become an important tool for making statements about certain groups, people, or entire communities. A questionnaire is a quick and easy technique to get information from a big number of people in a short amount of time. A well-constructed questionnaire is important to the success of a survey. Appropriate questions, correct question ordering, correct scale, or a decent questionnaire style can make the survey beneficial because it can accurately reflect the participants' ideas and opinions. As a result, the design of the questionnaire is critical to ensuring reliable data collection so that the results are interpretable and generalizable. A poor questionnaire makes the data unintelligible or, worse, may lead to incorrect conclusions.

The type of questionnaire chosen for this study was one with closed-ended questions. Closed-ended inquiries are frequently used to describe someone's traits, ideas, or attitudes (Dillman et al., 2014). Respondents to closed-ended questions have a restricted number of precise responses from which to pick. In this study, closed-ended type of questions was used which is Likert scale questions. With this, respondents only need to rate from 1 to 5 Likert scale on their agreements and preferences on the measurement statements provided. This method saves them time and prevents them from becoming bored while answering the questions.

3.4.1 Statements Measurements

Ten statements were devised early on to better understand the pre-evacuation behaviour of USM Engineering Campus staff and students during an emergency evacuation. Five of the ten statements assessed the occupants' recognition of the